

STATE OF WEST VIRGINIA
OFFICE OF MINERS' HEALTH, SAFETY AND TRAINING

GUIDELINES FOR GROUND MONITOR SYSTEM WAIVER – A.C. AND D.C.
In Lieu of Chapter 22A, Article 2, Section 40(43)
Title 56, Series 3, Section 37.7(c)

CHAPTER 22A, ARTICLE 2, SECTION 40(43) PROVIDES:

Except where waived by the Director, metallic frames, casings, and other enclosures of electric equipment that can become alive through failure of insulation or by contact with energized parts shall be grounded, and on or before the first day of January, one thousand nine hundred and seventy-eight, shall have a ground monitoring system.

The following guidelines shall govern waiver of the grounding and ground monitoring requirements by the Director.

I. DEFINITIONS --

“Low-Resistance Ground Field” means constructed of electrodes, buried metallic piping system, metal framework of a building, well or borehole casing, steel piling or other buried metallic materials having a total resistance to ground of not more than 5 ohms. Low-resistance ground fields shall be measured at the time of installation and at least annually thereafter to insure that a sufficiently low resistance to ground has been achieved and is being maintained. The results of such measurements shall be recorded and made available to an authorized representative of the Office of Miners' Health, Safety and Training.

“Ground-Fault Indicator” means a device to provide ground-fault indication for an underground circuit. Ground-fault indicators shall be adjusted to give a visual indication when the line-to-ground voltage on any power conductor decreases to less than 30 percent of the nominal system voltage for a circuit supplied power from a three-phase system, or less than 50 percent of the nominal voltage for a circuit supplied power from a single-phase system.

“Ground-Check Circuit” means a device to insure a safe, dependable path for fault current which will cause the circuit breaker to open:

- (a) If a ground-check conductor is used, when the ground-check conductor is broken; or
- (b) If no ground-check conductor is used, when the ground wire is broken at any point in the grounding circuit.

However, where low-resistance parallel paths for fault current and monitoring current are present, the ground-check circuit will be acceptable if it is designed to open the circuit breaker when the impedance of the ground circuit increases beyond the amount necessary to cause a 40-volt drop in the grounding circuit external to the grounding resistor under fault conditions in low and medium voltage circuits or a 100 volt drop in the grounding circuit external to the grounding resistor under fault conditions in high-voltage circuits.

II. PORTABLE AND MOBILE THREE-PHASE EQUIPMENT --

All three-phase circuits extending to low, medium, and high-voltage portable and mobile equipment shall be provided with a ground-check circuit for the grounding conductor pursuant to Chapter 22A, Article 2, Section 40, Subsections (61) and (73).

III. STATIONARY THREE-PHASE EQUIPMENT –

All stationary three-phase equipment shall comply with the provisions of Chapter 22A, Article 2, Section 40(43) unless a waiver is granted by the Director of the Office of Miners' Health, Safety and Training. A waiver will be granted on a mine-by-mine basis upon application to the Director if one of the following methods is used:

A. UNGROUNDING SYSTEMS

1. Low, Medium, and High-Voltage Circuits

A grounding conductor one-half the size of the power conductors shall originate from a low-resistance ground field at the power source. Such grounding conductor shall be connected to the metallic frames and enclosures of the power source and shall extend along with the power conductors as a grounding circuit for the metallic frames and other metallic enclosures of all stationary equipment receiving power from the system. The grounding conductor shall also be connected to a low-resistance ground field(s) at the service equipment for buildings and other stationary installations. Such circuits shall be provided with a ground-fault indicator located at a location monitored by a competent person, and a ground-fault shall not be allowed to exist for more than 24 hours.

2. High-Voltage Circuits

When earth is used a grounding conductor for the metal frames and enclosures of stationary equipment, the interrupting time of the circuit breaker or fuses and the design of the ground grid shall be in accordance with the Institute of Electrical and Electronics Engineers (IEEE), No. 80-1972, "Guide for Safety in Alternating Current Substation Grounding." A professional engineer shall certify that the ground grids and circuit protection are installed in accordance with said standard.

3. High-Voltage Circuits

Circuits being supplied power from an ungrounded system shall be protected by a circuit breaker equipped with a device to provide ground-fault protection when one phase becomes grounded. The device shall cause the circuit breaker to trip when the line-to-ground voltage of any power conductor decreases to less than 30 percent of the nominal system voltage for a circuit supplied power from a three-phase system. Low-resistance ground fields shall be installed and maintained at the source transformers and service equipment installations. The ground fields shall have sufficiently low impedance to facilitate opening the circuit breaker under fault conditions. The grounding conductors, metal frames and enclosures of the source transformers, and service and utilization equipment shall be connected to the respective ground field.

4. Low Medium, and High-Voltage Circuits

Systems shall be installed in accordance with the recommendations set forth in the National Electrical Code which is in effect at the time of installation. Existing systems installed according to the "1968" dated National Electrical Code may also be accepted. The Director of the Office of Miners' Health, Safety and Training shall have jurisdiction over the enforcement of the Code and will have responsibility for making interpretation of its rule.

B. GROUNDING SYSTEMS

1. Low Medium and High-Voltage Circuits

Equipment receiving power from a grounded power system shall be protected by a circuit breaker equipped with devices to provide ground-fault tripping for the circuit. Low-resistance ground field shall be installed at the source transformers and each service equipment installation. A grounding conductor shall originate from the ground field at the source transformers and serve as the grounding circuit for the metal frames and enclosures of all equipment receiving power from the circuit. The grounding conductor shall also be connected to a low-resistance ground field at each service equipment installation.

2. Low Medium and High-Voltage Circuits

Systems shall be installed in accordance with the recommendations set forth in the National Electrical Code which is in effect at the time of installation. Existing systems installed according to the "1968" dated National Electrical Code may be accepted. The Director of the Office of Miners' Health, Safety and Training shall have jurisdiction over enforcement of the Code and will have responsibility for making interpretations of its rules.

3. High-Voltage Circuits

When the earth is used a grounding conductor for the metal frames and enclosures of stationary equipment, the interrupting time of the circuit breaker or fuses and the design of the ground grid shall be in accordance with the Institute of Electrical and Electronics Engineers (IEEE), No. 80-1971 "Guide for Safety in Alternating Current Substation Grounding." A professional engineer shall certify that the ground grids and circuit protection are installed in accordance with said standards.

IV. PORTABLE, MOBILE, AND STATIONARY SINGLE-PHASE EQUIPMENT –

All portable, mobile, and stationary single-phase equipment shall comply with the provision of Chapter 22A, Article 2, Section 40(43), unless a waiver is granted by the Director of the Office of Miners' Health, Safety and Training. A waiver will be granted upon application thereof which sets forth a positive program that will assure continuity of the grounding circuit. Criteria for acceptance shall be as follows:

1. Double Grounding (separate connections);
2. UL Approved Double Insulated;
3. GFCI (Ground Fault Circuit-Interrupter);
4. Compliance with National Electrical Code in effect at time of installation; or
5. Any Other No Less Effective Approved Method.

V. PORTABLE, MOBILE, AND STATIONARY D.C. EQUIPMENT –

Temporary waivers will be granted for monitoring D.C. Ground Circuits upon request by a mine operator until effective systems for conducting such monitoring have been developed and are commercially available.

VI. PREPARATION PLANTS –

Where not already provided for above, in preparation plants, shops, and other metal structure installations, the metal frames and enclosures of electric equipment shall have two separate grounding connections to the ground medium (Double-Grounded). In addition, where flexible conduit is used as part of the ground circuit, shunts shall be installed to bridge the flexible conduit.